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PATENT SPECIFICATION



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459,125

COMPLETE SPECIFICATION

Improvements in or relating to the Manufacture of Paper

We, THE MEAD CORPORATION, a corporation organised under the laws of the State of Ohio, United States of America, of Chillicothe, Ohio, United States of America (Assignees of LEONARD RAYMOND GROWDON), do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the manufacture of paper and more particularly to paper manufacture in which fibrous stock is flowed on to a forming wire to effect an initial definite web formation, after which additional paper forming material is added to the wire side of the web to be incorporated as part of the subsequently finished sheet.

The expression "Additional paper forming material" does not mean optional additions for obtaining special effects, such as staining by means of dyes, waxes, resins, oils or the like, but material which is normally used for the formation of paper and is added and replaces wholly or in part that material which has been lost from the web during water withdrawal. It will be appreciated that while the materials are always such as are normally used for the formation of paper they are not invariably the same in composition or quantity as those which were lost during the water withdrawal. Thus the web which contained only fibre and size when originally formed may have filler added thereto.

One of the principal objects of the invention is to provide a method of incorporating and properly distributing additional paper forming material in a web of paper before its formation into a dried sheet of paper is completed. It is a further object to provide a simple construction of apparatus for carrying out the invention. It is also an object to provide as a new article of manufacture a sheet of paper so made and comprising a fibrous material and filler in which the filler is distributed upon both sides of the paper sheet in controlled manner, the

surface of the sheet of paper being free of suction roll marking.

Paper is manufactured in accordance with the invention by forming a wet paper web, adding additional paper forming material to the wire side of the wet web, and subjecting the web to a suction operation, the suction being applied to the side of the web opposite that to which the additional paper forming material was added. The additional paper forming material may be added to the wire side of the paper through the original forming wire; however, preferably the additional paper forming material is added to the paper web while the latter is on a separate conveyor, so that the white water system associated with the original forming wire is not affected by the additional paper forming material as hereinafter referred to.

In carrying out the invention, paper making stock may be flowed onto the travelling wire of a forming machine through which drainage is effected in the usual manner to effect an initial definite web formation. A suction couch roll is preferably provided so that as the web passes over the couch roll, it is subjected to a suction operation on its lower or wire side. This suction operation, in addition to the drainage action taking place along the forming wire and the usual suction boxes, causes the removal of water and certain portions of the paper stock such as the finer fibers and part of the filler material if such is present in the stock, particularly from the wire side of the web. The removed water and other material, commonly referred to as "white water", is collected and recirculated to be reused, thereby preventing the loss of any of the paper forming constituents which have passed through the wire.

The web may be removed from the forming wire, and suitable apparatus is provided for applying the above-defined additional paper forming material to the wire side of the web before its formation into a dried paper sheet is completed. The above-defined additional material may be supplied in suitable amount to

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provide predetermined surface characteristics in the finished sheet by way of compensation for that material which was removed from the wire by drainage.

5 Thereafter the web, with its additional paper forming material, and while still wet and in a sufficiently receptive condition, is subjected to a suction operation, the suction being applied to the side of
10 the web opposite that to which the additional paper forming material was added. This results in incorporating the additional paper forming material in a very satisfactory manner into the body
15 of the sheet, and prevents withdrawal of a large part of the additional material in the suction operation such as occurs when suction is applied to the same side of the web as that to which the additional
20 material has been added.

Inasmuch as the additional paper forming material referred to above is not added until after the web has left the forming wire, the web is in a relatively
25 drier state than it is prior to its passage over the couch roll. Accordingly a larger quantity of additional paper forming material can be incorporated and maintained upon and within the body of
30 the web than when such additional material is added to the web while still on the wire, and likewise a better control is obtained over the way in which it is added. Similarly, because of a drier condition of the sheet, there is practically no
35 marking effect such as may be produced by high vacuum suction rolls. To further eliminate the undesirable effect of suction roll marking, the web is preferably subjected to suction while supported upon a
40 felt. In this way, with the suction being applied through the felt, the objectionable effect of marking in the pattern in the perforations of the suction roll is entirely eliminated for the very fine
45 interstices of the felt so distribute the suction action as to prevent any such marking.

The application of the additional paper forming material may be entirely separate from the white water system of the forming machine. As is well known, the
50 common practice in the manufacture of paper is to collect the drainage water draining through the forming wire and to recirculate it back to the stock chest for reuse. This drained water, commonly known as white water, contains a considerable quantity of the smaller fibers
60 and entrained mineral materials which have passed through the wire, and accordingly it is important that this material be recovered and reused. Also upon the breaking of the sheet, and
65 its failure to pass over to the presses and

the driers, the entire web is carried around by the wire and is washed off into the same collecting means by means of showers. Under such temporary circumstances it is customary to keep the machine operating, all of the web material being collected and continually recirculated, but the supply of new stock constituents is cut off to prevent the accumulation of such material in the
7 recirculating system. If then no additional paper forming material is added, the entire web material is recirculated during the period of the break, without
7 any change in the proportions thereof for no material is added or lost in any appreciable quantities.

When however, additional paper forming material is added, as for instance by means of the wire guide roll, such addition
8 takes place continually and this additional material is recirculated in the white water system and results in a continual building up of the proportion of the additive material since more is being
9 continually added and none lost. Accordingly when the web again carries through, it will have an abnormally high percentage of the additive material and the result will be the production, for a
9 period of time, of paper of non-uniform characteristics. This produces an undesirable operating condition, resulting in loss of a part of the formed paper, and may make it difficult to obtain accurate control of the constituents of the sheet.

The present invention may be so carried out that the white water system is entirely separate from that including the additional paper forming material. The
10 arrangement is preferably such that the additional paper forming material is supplied only in case a web is being removed from the forming wire, and is so supplied to the web that in any event no
11 drainage takes place into the white water system. Thereby it is possible to maintain accurately controlled and predetermined stock constituents.

In order that the invention may be
11 fully understood, it will now be described with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic view showing one manner of practising the present
12 invention;

Figure 2 is a detail view showing a slightly modified construction for carrying out the invention;

Figure 3 is an alternative arrangement
12 of apparatus suitable for carrying out the invention; and

Figures 4 to 6 are detail views showing further modifications of apparatus for performing the invention.

Referring to the drawings which illustrate a preferred embodiment of the invention, paper making stock from a head box (not shown) is supplied to a travelling forming wire 10 with resultant initial formation of a web of paper 12. The wire passes over the couch roll 13 which is provided with the conventional suction box construction 14. The remainder of the forming machine construction and the white water collecting system is not shown as it may comprise a conventional arrangement of such.

In the arrangement shown in Figure 1, the web, after leaving the couch roll, passes under a guide roll 15, and is then carried forwardly upon an auxiliary travelling wire 16 which rotates around a plurality of guide and driving rolls 17. This arrangement comprises an application roll 18 rotating in a bath of the additional paper forming material. The constituents of this material will generally consist principally of a mineral filler material in conjunction with a size. Conventional mechanism may also be provided for maintaining a predetermined level of the material in the trough 19. For example the material may comprise a suspension of a carbonate, or other similarly acting filler in water, containing twenty-two pounds of carbonate filler and 3.5 pounds of size, such as boiled starch, in forty gallons of water.

Roll 18 carries a film of this material upwardly into contact with the travelling wire 16, and the additional paper forming material is thereby carried into contact with and incorporated within the body of the paper web 12. Part of the water has been removed before the web reaches this point and it is in a receptive condition for such additional material.

After the additional material has been added to the web, the web is brought into contact with a travelling felt 20, travelling in the same direction as the paper, which is directed into contact with the upper surface of the web by a guide roll 21. This felt couches the web from the auxiliary wire and carries it upwardly passing a second guide roll 22. From the guide roll 22 the web is carried into a suction press, indicated generally at 23, the felt continuing through the press and around suitable tensioning mechanism 24 which is adjustable in the usual manner.

The wet press 23 comprises an upper roll 25 and a lower roll 26 which latter is provided with a suction box arrangement 27. The purpose of this arrangement is to apply suction to the side of the wet web opposite that to which the additional paper forming material was added,

to remove water from the web, and at the same time to compact the constituents of the web by drawing the newly applied material into the web interstices and distributing it therein. The preferred manner of so doing is to turn the web over by the arrangement just described and then to apply suction to the lower side thereof, which is the side opposite that to which the additional paper forming material was applied.

It will be noted that as the web passes through the first press 23, it is supported by the travelling felt 20. Furthermore the suction is effective upon the web through the felt 20. Consequently no suction roll marking will be obtained. Inasmuch as any marking produced by the suction couch roll has been eliminated by the application of the additional paper forming material to that side of the web, the result is to provide a web of very superior surface characteristics on both sides, and substantially completely free of any suction roll marking.

It should be further noted that in this embodiment, the felt contacts the side of the web opposite that to which the additional paper forming material was added. Suction is applied through the web but the surface of the web at the time the suction is applied is in a sufficiently definite stage of formation so that the suction effect on the newly applied material tending to draw it down into the web results in only incidental material being drawn from the formed web into the felt. Thus no objectionable effects are imparted to the surface of the web and no objectionable loading of the felt with filler or the like occurs. Consequently the felt life is prolonged and difficulties in cleaning the felt are not encountered.

After leaving the first press 23, the web passes over suitable guide roll 30 and is then carried forward upon a travelling felt 31 and through the rolls 32, 33 of a second wet press. This press performs the usual wet pressing operation. If desired the web may be carried on a felt 34 through a third set of press rolls 35, 36 after which it passes to the driers, indicated generally at 37 where it may be dried in the conventional manner.

Figure 2 shows a slightly modified arrangement comprising the travelling wire 18¹, and a colour application roll for applying the additional paper-forming material 18¹ operating in a trough 19¹. Instead however, of couching the web 12¹ from the auxiliary wire by means of a travelling felt, the felt 20¹ is carried around guide rolls 21¹, 22¹ without contacting the web. The web passes around auxiliary guide rolls 21^a and 22^a sup-

porting itself, and is thereafter carried through the press 23¹ comprising rolls 25¹, 26¹ and suction device 27¹, upon the felt 20¹. In cases where the web is not sufficiently strong to be self-supporting, this arrangement will not be satisfactory, and the arrangement of Figure 1 in which the web is actually carried upon the travelling felt will give better operating results.

Figure 3 shows a modified arrangement in which the web, though still wet, contains less moisture at the time of the application of the additional paper forming material thereto. In this arrangement the web is first subject to a preliminary pressing operation before the additional paper forming material is added. Referring to Figure 3, the wet web is shown at 40, upon the travelling forming wire 41. The couch roll 42 is provided with a suction box 43. Upon leaving the couch roll, the web passes under guide roll 44 and is carried forward upon a travelling felt 45. The felt carries the web through a set of press rolls 46, 47 the latter of which may be provided with a suction box 48 to further reduce the water content of the web. A suitable mechanism 49 provides for the driving and tensioning of the endless felt 45.

After leaving the press rolls 46, 47, the still wet web passes over a guide roll 50 and is then supported upon an auxiliary member 51, preferably a wire. A suction box 52 may be provided for drawing the web down into close contact with the wire. Thereafter the wire passes over an application roll 53, rotating in a trough 54, which is supplied with the additional paper forming material. This roll operates as described above to supply a predetermined amount of the additional paper forming material to the web through the auxiliary forming wire. Thus any marking produced by suction rolls 43 or 48 is obliterated. The wire passes over a guide and driving roll 55, which may conveniently be the bottom roll of the conventional second press.

The web with the additional paper forming material supplied to the wire side thereof next passes to an auxiliary travelling felt 58 which carries the web toward a wet press indicated generally at 60. The web leaves felt 58 and is turned around guide rolls 61, 62 which turn it over and guide it toward the nip of the press. A travelling felt 63 travels over suitable guide rolls 64 and is arranged to support the web and carry it through the press 60. If the web does not have sufficient strength to be self-supporting, the felt may be used to couch the web from

the wire, in the manner shown in Figure 1.

The lower roll 65 of press 60 is provided with a suction box 66. As in the other arrangements, this provides for the application of suction from the bottom side of the web, which is the side opposite that to which the additional paper forming material was added. As described above, the effect of suction on this side of the web is to provide for the incorporation and distribution of the additional paper forming material into the body of the web.

After passing through the third press 60, the web passes to suitable driers where it is dried in the conventional manner.

In Figure 4 there is shown an alternative arrangement of means for applying the additional paper forming material to the web. In this modified construction the wet web 70, after leaving the couch roll of the forming machine, is brought into contact with and is carried forward by a member 71 which may comprise a travelling felt or the like. If desired the web may also be subject to a wet pressing operation after leaving the couch roll. The web is then carried around guide rolls 72, 73 which are so positioned that the web travels substantially vertically upward. A travelling felt 74 is carried over the guide rolls 75, 76 and 77. The guide roll 76 is so positioned that it brings the felt against the web 70 intermediate rolls 72 and 73 to thereby support the web. An auxiliary wire 78 is arranged over guide rolls 79, 80 so that it travels substantially parallel with the travel of the web 70 but spaced slightly therefrom. The wire passes over a fountain roll 81 rotating in a trough 82 to which the additional paper forming material is supplied. Preferably the parts are constructed to cause the travel of the auxiliary wire, opposite to that of the travel of the wire where the web and the wire are adjacent each other. In passing over the fountain roll 81, the wire picks up a quantity of the additional paper forming material which is carried along in the interstices of the wire. An air jet 83 is positioned opposite the backing roll 76 and is arranged to blow a quantity of the additional paper forming material from the auxiliary wire directly onto the paper web. As indicated, the application of this additional material is preferably made to the wire side of the web. Backing roll 76 prevents displacement or breakage of the web by the air stream.

The web then passes through the press rolls 84 and 85 of a suction press, roll 85 180

being provided with a suction device 86. Thus the suction is applied to the side of the sheet opposite that to which the additional paper forming material was added.

5 Figure 5 shows a further modified construction in which the wet web 90 is carried forwardly on an auxiliary carrying member 91. Upon leaving the member 91 the web passes around guide rolls 92, 93 and into the nip of press rolls 94, 95. A travelling felt 96 passing around guide rolls 97, 98 provides for supporting the web as it passes through the press. The lower press roll 95 is provided with a suction box 99.

15 The upper press roll 94 in this arrangement serves as a means for applying the additional paper forming material to the travelling web. A fountain roll 100 is suitably rotated in a trough 101 containing the additional paper forming material so that it picks up a film of such material upon its surface. A rotating brush 102 is arranged to contact the surface of roll 100, pick off the film of additional paper forming material and to carry it onto the surface of press roll 94 which it also contacts. This results in the application of the additional forming material to what at that point is the top side of the web, but which is actually the wire side of the web. Accordingly the suction supplied to roll 95 is effective upon the side of the sheet opposite that to which the additional paper forming material was added and this additional material is thereby properly incorporated into the body of the sheet.

20 Figure 6 shows a further modification in which the wet web 110 is brought into contact with a travelling felt 111. This felt passes under a suitable guide roll 112 on its lower run, and the bottom surface thereof is brought into contact with a colour application roll 113 rotating in a trough 114 suitably supplied with the additional paper forming material. The roll 113 therefore picks up a film of additional paper forming material on its surface and supplies it to the surface of the travelling felt 111. The felt travels around guide roll 115 and into contact with the travelling web of paper 110. In this way the additional paper forming material is supplied to the surface of the wet web.

25 After leaving the travelling felt, the web passes around guide rolls 116, 117 and into the nip of press rolls 118, 119. A travelling felt 120 passing around suitable guide rolls 121, 122 provides for supporting and carrying the web through these press rolls. Press roll 119 is provided with a suitable suction box 123 so that suction can be applied to that side of

the sheet opposite that to which the additional paper forming material was added.

It will be understood that each of the constructions shown in Figures 4, 5 and 6 are adapted to be utilized in any suitable arrangement, such as that shown in Figure 1, where the additional paper forming material is added after the web leaves the couch roll and before any further processing, or that shown in Figure 3 where the web is subjected to a pressing operation before the additional paper forming material is added. It will also be understood that additional pressing operations prior to or subsequent to the application of the additional paper forming material and the application of the suction thereto, can be provided as desired.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of forming a sheet of paper which comprises forming a wet paper web, adding additional paper forming material to the wire side of the wet web, and subjecting the web to a suction operation, the suction being applied to the side of the web opposite that to which the additional paper forming material was added.

2. A method of forming a sheet of paper which comprises forming a wet paper web, adding additional paper forming material to the wire side of the wet web, turning the web over, and then applying suction to the web on the side opposite that to which the additional paper forming material was added to obtain a uniform distribution of the additional paper forming material in the web.

3. A method of forming a sheet of paper which comprises forming a wet web of paper on a travelling forming wire, carrying the web forward on an auxiliary travelling member, applying additional paper forming material to the web through said auxiliary member, and subjecting the web to a suction pressing operation, the suction being applied to the side of the web opposite that to which the additional paper forming material was added.

4. A method according to any of the preceding claims which includes extracting moisture from the wet web before the additional paper forming material is added.

5. A method of forming a sheet of paper which comprises forming a wet paper web on a travelling forming wire, carrying the web forwardly after leaving the wire on a travelling felt, wet pressing

the web while travelling on said felt, bringing the web into contact with an auxiliary travelling wire, adding additional paper forming material through said auxiliary wire to the wet web, turning the web over, subjecting the lower side of the turned-over web to a suction pressing operation to obtain a uniform distribution of the paper forming material in the web, and preferably subsequently wet pressing the web with the incorporated additional paper forming material.

6. A method according to claim 3, 4 or 5 which includes effecting the formation of the wet web on the wire by drainage through the wire, collecting the white water draining through the wire and returning it to be reused, and subsequently adding the additional paper forming material to the web at a position so spaced from the point at which the white water is collected that none of the additional paper forming material is recirculated with the white water.

7. A sheet of paper whenever formed by the method according to any of claims 1 to 6.

8. Apparatus for forming a sheet of paper comprising a travelling forming wire for forming a wet web of paper, and means for supplying additional paper forming material to the wire side of the wet web, and including a suction press and means for carrying the web with its additional paper forming material through said suction press in such a manner that the suction is applied to the side of the web opposite that to which the additional paper forming material was added.

9. Apparatus for forming a sheet of paper comprising a travelling wire and an auxiliary wire adapted to receive the wet web of paper and spaced from the

forming wire, and including means for supplying additional paper forming material through said auxiliary wire to the web of paper, a suction press being provided and means for carrying the web of paper with the additional paper forming material through said suction press in such position that the suction is applied to the side of the web opposite that to which the additional paper forming material was added.

10. Apparatus according to claim 8 or 9 including a travelling felt for couching the web from said auxiliary wire, and means for directing said felt with the wet web of paper through said suction press.

11. Apparatus according to claim 8, 9 or 10 including a wet press for subsequently treating the web having the incorporated additional paper forming material.

12. Apparatus according to any of claims 8 to 11 including means for collecting the white water draining through the wire and for returning it for recirculation, the means for adding additional paper forming material being so spaced from said collecting means that none of the additional paper forming material is recirculated with the white water.

13. A method of forming a sheet of paper substantially as hereinbefore described.

14. Apparatus for forming a sheet of paper substantially as hereinbefore described and illustrated in the accompanying drawings.

Dated the 29th day of March, 1935.
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[This Drawing is a reproduction of the Original on a reduced scale.]

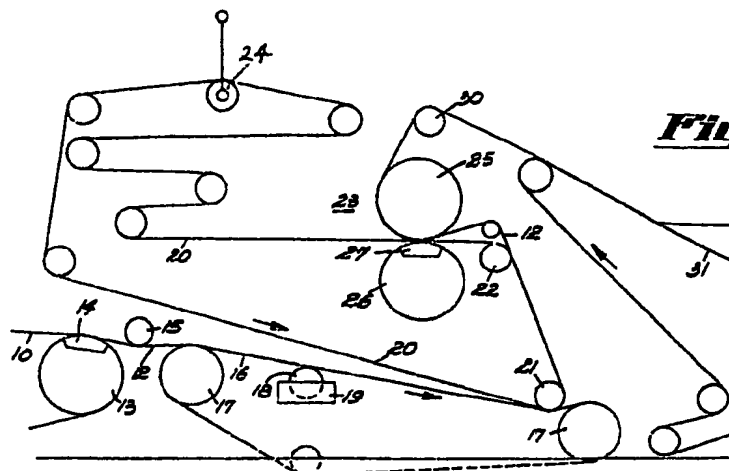


Fig. E

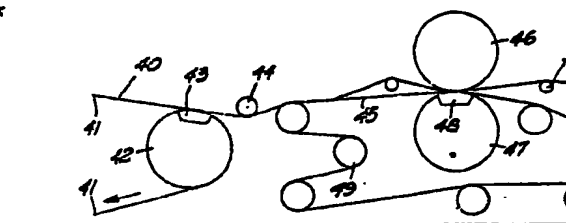
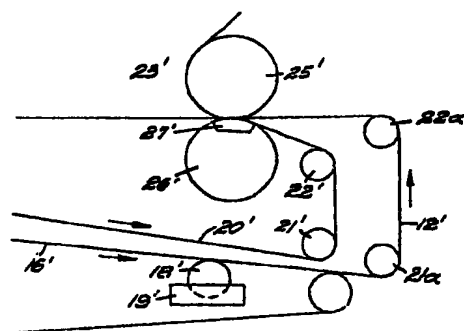


Fig. 4

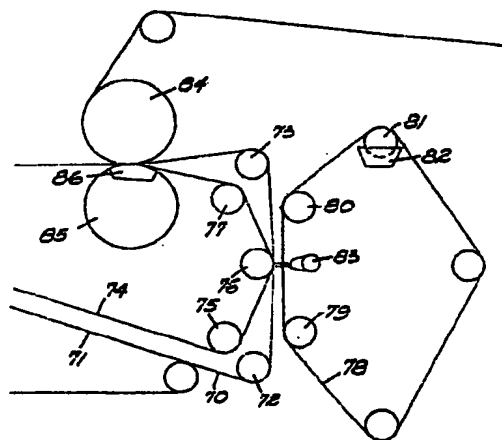
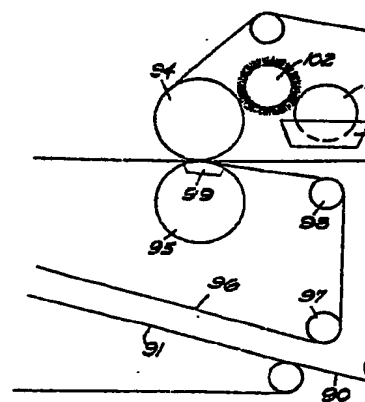
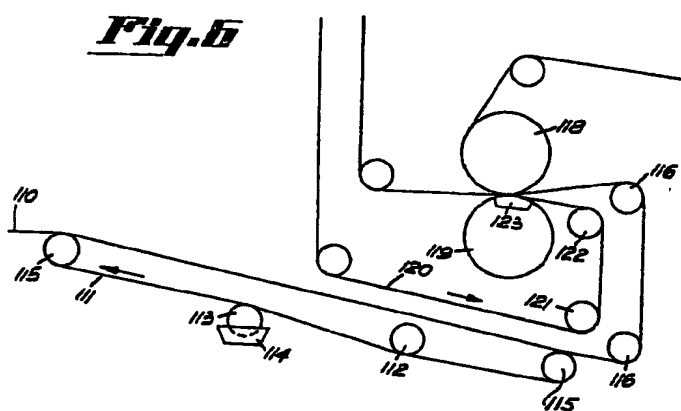
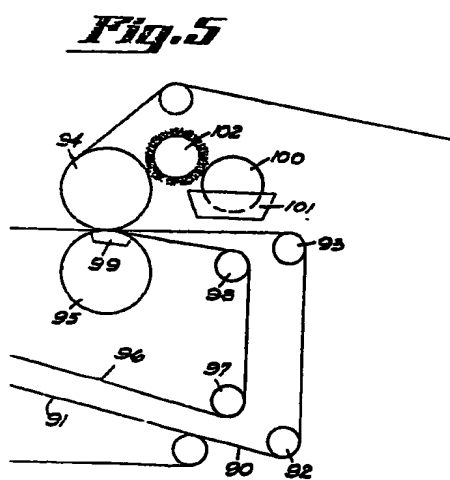
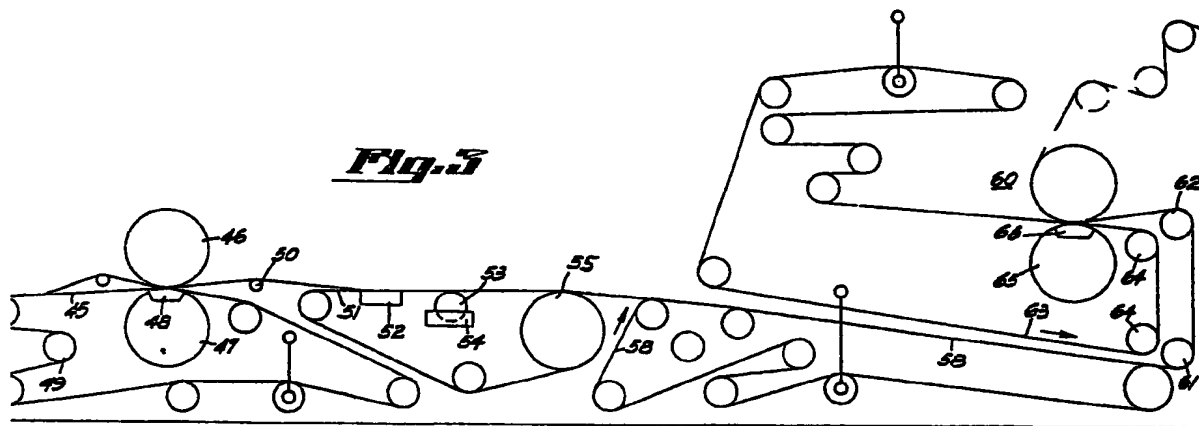
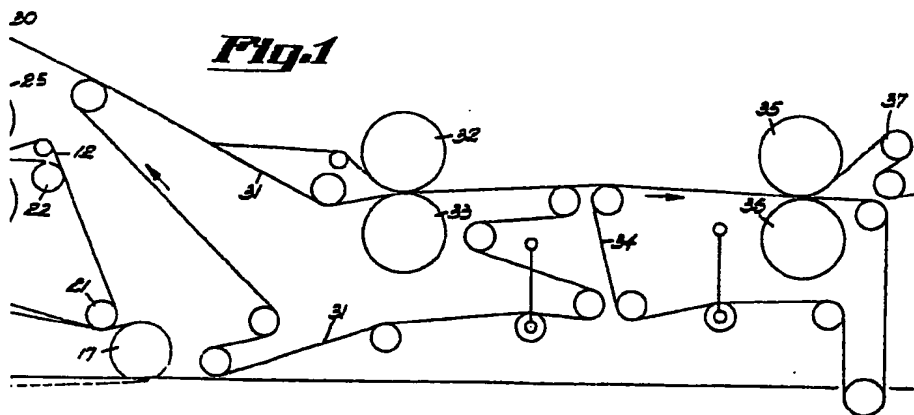


Fig. 5





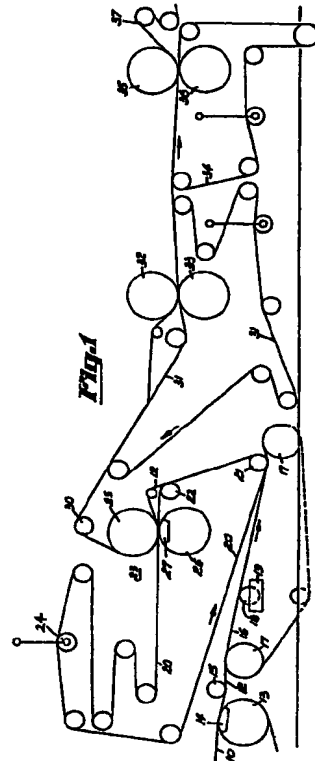


Fig. 1

Fig. 2

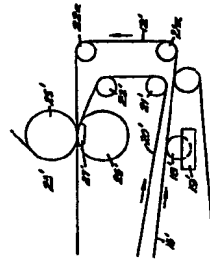


Fig. 3

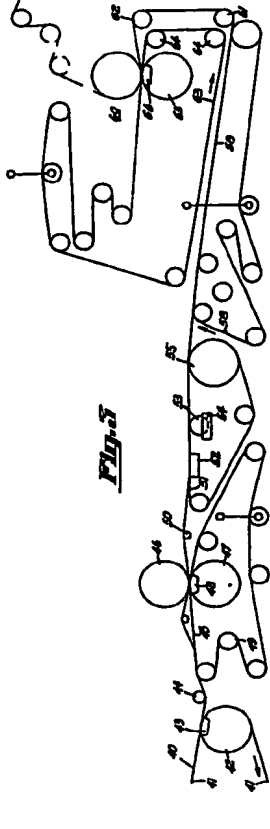


Fig. 4

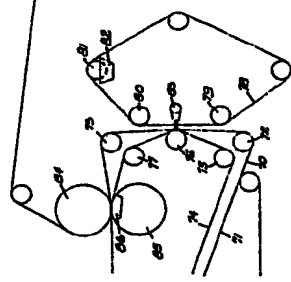


Fig. 5

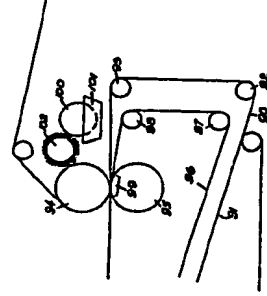
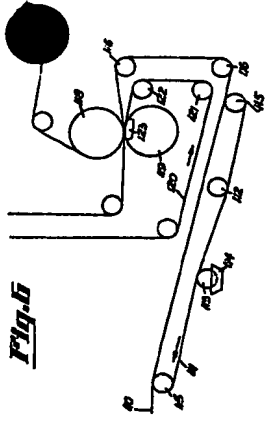


Fig. 6



[This Drawing is a reproduction of the Original on a reduced scale.]

